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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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10/743,608

12/22/2003

Sang Woo Nam

20063/10006

7552

34431

7590

04/05/2006

HANLEY, FLIGHT & ZIMMERMAN, LLC  
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EXAMINER

FULK, STEVEN J

ART UNIT

PAPER NUMBER

2891

DATE MAILED: 04/05/2006

Please find below and/or attached an Office communication concerning this application or proceeding.

# Office Action Summary

Application No.

10/743,608

Applicant(s)

NAM, SANG WOO

Examiner

Steven J. Fulk

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2891

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --  
Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

## Status

- 1) ☒ Responsive to communication(s) filed on 08 March 2006.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

## Disposition of Claims

- 4) ☒ Claim(s) 1 and 2 is/are pending in the application.
- 4a) Of the above claim(s) \_\_\_\_\_ is/are withdrawn from consideration.
- 5) ☐ Claim(s) \_\_\_\_\_ is/are allowed.
- 6) ☒ Claim(s) 1 and 2 is/are rejected.
- 7) ☐ Claim(s) \_\_\_\_\_ is/are objected to.
- 8) ☐ Claim(s) \_\_\_\_\_ are subject to restriction and/or election requirement.

## Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 22 December 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.  
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).  
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

## Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some \* c) ☐ None of:
1. ☒ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. \_\_\_\_\_.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

\* See the attached detailed Office action for a list of the certified copies not received.

## Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)  
Paper No(s)/Mail Date \_\_\_\_\_
- 4) ☐ Interview Summary (PTO-413)  
Paper No(s)/Mail Date. \_\_\_\_\_
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: \_\_\_\_\_

## **DETAILED ACTION**

### ***Continued Examination Under 37 CFR 1.114***

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on March 8, 2006 has been entered:

### ***Claim Rejections - 35 USC § 103***

2. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

3. Claims 1 and 2 are rejected under 35 U.S.C. 103(a) as being unpatentable over Tsau '306 in view of Lee et al. '135, and further in view of Huang et al..

a. Tsau discloses a method for forming a capacitor and a contact hole of a semiconductor device simultaneously, comprising the steps of depositing a TiN barrier layer and a metal layer (fig. 4, 402) consisting of copper, copper alloy (col. 3, lines 28-41), aluminum or refractory metal (col. 2, lines 37-52) on a substrate (102); forming a capacitor part (fig. 5, 502) and a contact part (504) using the TiN layer and metal layer; forming an insulating layer (602) formed of nitride over the substrate, including the capacitor part and

the contact part, and then forming a thicker interlayer dielectric layer (702) on the insulating layer; forming a first photoresist pattern (fig. 8, 802) on the ILD and removing parts of the ILD over the capacitor part (fig. 9, 902) and the contact part (904); forming a second photoresist pattern (fig. 11, 1102) over the ILD and removing material over the contact to expose the contact to the metal layer (fig. 12, 1204); filling the openings with metal to form the upper capacitor electrode (fig. 15, 1502) and the contact interconnect (1504).

Tsau does not explicitly disclose depositing the TiN barrier layer directly on the surface of the metal layer, and subsequently removing some part of the TiN barrier with the insulating layer when opening the contact hole to expose the metal layer. Lee et al. teaches a method for forming a capacitor and a contact hole of a semiconductor device simultaneously, comprising depositing a metal layer (fig. 5, 112) on a substrate (110), depositing a TiN layer directly on the metal layer (114), patterning a capacitor part (112a) and a contact hole part (112b) of the layers, forming an insulating layer (fig. 7, 120) and ILD layer (116) over the contact hole part, opening a contact hole through the ILD, insulating layer, and TiN layer to expose the contact hole to the metal layer (fig. 8, 124), and filling the opening with a second metal layer (126).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the metal/TiN stack of Lee et al. in the capacitor device of Tsau. One would have been motivated to do this because

using a TiN layer on top of a metal layer was a conventional method of reducing hillocks on the surface of the metallic layer (Lee et al., col. 4, lines 22-25), thus improving the performance of the capacitor.

b. Further, while Tsau teaches that refractory metals can be used in semiconductor interconnects, the reference does not explicitly teach the use of the refractory metal tungsten as the metal to form the upper capacitor electrode and contact interconnect. Huang et al. teaches the use of tungsten in the metallization of a semiconductor device (column 6, lines 38-47).

It would have been obvious to one of ordinary skill in the art at the time the invention was made to use the tungsten metallization of Huang et al. in the capacitor device of Tsau. One would have been motivated to do this because tungsten was a conventional metal used in interconnect metallization due to its compatibility with damascene CMP processes, high conductivity, and high melting point.

#### ***Response to Arguments***

4. Applicant's arguments with respect to claims 1 and 2 have been considered but are moot in view of the new ground(s) of rejection as discussed above.

#### ***Conclusion***

5. The prior art made of record and not relied upon is considered pertinent to applicant's disclosure.

a. Adler et al. '128, Ma et al. '234 and Sung et al. '454 discloses methods of simultaneously forming a metal-insulator-metal capacitor and a contact via

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hole, wherein a barrier layer is deposited on the surface of the lower plate of the capacitor.

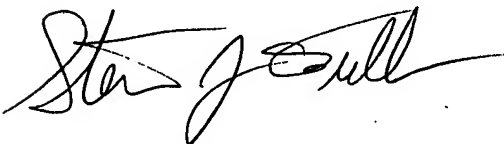
b. Shao et al. '747, Gambino et al. '423 and Sun '629 disclose methods of simultaneously forming a metal-insulator-metal capacitor and a contact via hole.

6. Any inquiry concerning this communication or earlier communications from the examiner should be directed to Steven J. Fulk whose telephone number is (571) 272-8323. The examiner can normally be reached on Monday through Friday, 9:00am to 5:30pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Bill Baumeister can be reached on (571) 272-1722. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

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7. Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).



Steven J. Fulk  
Patent Examiner  
Art Unit 2891



**BRADLEY K. SMITH**  
**PRIMARY EXAMINER**

March 29, 2006